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Original Contribution

Comparison of the Pentax, Truview, GlideScope, and the Miller laryngoscope for child intubation during resuscitation ☆,☆☆,★

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SUMMARY

Background: The study was designed to compare the effectiveness of 3 video laryngoscopes with the Miller laryngoscope during pediatric resuscitation.
Material and methods: This was a randomized crossover study involving 87 paramedics and 54 nurses. The primary end point of the study was the success rate of blind tracheal intubation, whereas the secondary end point was defined as the time from insertion of a device to the first manual ventilation of the manikin's lungs.
Results: The median time to intubation using the Pentax, Truview, GlideScope, and Miller varied with the times being 20.6 (interquartile range [IQR], 18-27) vs 20.1 (IQR, 18-23.3) vs 30.2 (IQR, 29.6-35) vs 41.3 (IQR, 33-45.2) seconds, respectively. The overall success ratios of intubation for the devices were 100% vs 100% vs 100% vs 79.4%.
Conclusions: We concluded that, in a pediatric manikin scenario, the video laryngoscopes are safe devices and can be used for pediatric intubation during uninterrupted chest compressions. Further clinical studies are necessary to confirm these initial positive findings.

1. Introduction

The main cause of sudden cardiac arrest in children is respiratory failure, not heart disease as is the case with adults [1,2]. The 2010 European Resuscitation Council and American Heart Association resuscitation guidelines emphasized the importance of minimizing interruptions to chest compression during cardiopulmonary resuscitation (CPR) [1-3]. These guidelines also suggest that the intubator should be able to secure the airway without interrupting chest compression. Securing the airway using an endotracheal tube carries many benefits. First, the placement of an endotracheal tube can accomplish stable ventilation support without additional pauses in chest compressions during CPR. Secondly, when access to the blood vessels is impossible, an endotracheal tube is an alternative method for the supply of resuscitation drugs. With the use of a tracheal tube, it is also possible to use a positive end-expiratory pressure and the concentration of carbon dioxide in exhaled air [4-6]. However, using the laryngoscope with Miller blade (MIL) for tracheal intubation is sometimes a difficult skill even for medical emergency professionals, and securing the airway becomes even more difficult in an emergent situation [7-9].

We hypothesized that video laryngoscopes are beneficial for intubation of pediatric manikins while performing CPR. In the current study, we compared the effectiveness of 3 video laryngoscopes and the Miller laryngoscope during resuscitation with uninterrupted chest compressions on a child manikin.

2. Materials and methods

This was a randomized crossover study involving 87 paramedics and 54 nurses, all of whom completed a 45-minute training program before the trial. The study was approved by the Program Committee of the International Institute of Rescue Research and Education (Warsaw, Poland; protocol no.: 08.2014.7.19). Detailed characteristics of the study group are presented in Table 1.

The study was based on training using a PediaSIM CPR training manikin (FCAE HealthCare, Sarasota, FL), which is designed to be an accurate representation of a 6-year-old child. Chest compression was performed using LUCAS-2 (Physio-Control, Redmond, WA). The Pentax-AWS (Pentax) (Aircraft Medical, Edinburgh, United Kingdom), the Truview PCD Pediatric Size 2 Set (TRUVIEW) (TRUPHATEK INTERNATIONAL LTD, Netanya, Israel), the GlideScope Ranger (GLIDESCOPE) (Verathon Inc, Bothell, WA), and the Miller Laryngoscope (MIL) (Rudolf Riester GmbH, Jungingen, Germany) were used in the study.

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☆☆ Conflict of interest statement: The authors declare that they have no conflicts of interests.
★ None of authors involved in this study has any financial relationship with any manufacturers of intubation devices.
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Table 1
Characteristics of the study group

Parameter	Paramedics (n = 87)	Nurses (n = 54)
Age (y) (mean ± SD)	33.6 ± 10.7	38.5 ± 15.4
Sex (n [%])		
Male	54 (62.1%)	5 (9.3%)
Female	33 (37.9%)	49 (90.7%)
Education level (n [%])		
Bachelor	59 (67.8%)	31 (57.4%)
Master	28 (32.2%)	23 (42.6%)
Work place (n [%])		
Emergency department	59 (67.8%)	38 (70.4%)
Emergency medical service	28 (32.2%)	16 (29.6%)
Work experience (mean ± SD)	11.5 ± 9.7	16.4 ± 8.4

The survey was voluntary and was conducted among "endotracheal intubation (ETI) trainees at the International Institute of Rescue Research and Education (Warsaw, Poland). Study enrollment occurred from May 2014 to July 2014.

After volunteer recruitment, a 45-minute training session on the technique involved in establishing ETI on a child patient during resuscitation was conducted, in accordance with the recommendations of the European Resuscitation Council. The training involved a discussion and presentation of the correct technique of airway management using the Pentax, Truview PCD, GlideScope Ranger, and the Miller Laryngoscope. After the training, the subjects were given 5 minutes of hands-on individual training on each method.

A Research Randomizer program was used [www.randomizer.com] to divide the volunteers into 4 groups and to determine the order in which to apply the different ETI devices within each group. The first groups attempted ETI using the Pentax, the second using the TRUVIEW, the third using the GlideScope, and the fourth using the Miller laryngoscope (Fig. 1). After completing the ETI procedure, participants had a 30-minute break before performing another emergency procedure.

The primary end point of the study was the success rate of ETI, whereas the secondary end point was defined as the time from insertion of an intubation device to the first manual ventilation of the manikin's lungs. To assess subjective opinions about the difficulty of the procedure, participants were asked to rate it on a visual analog scale with a score from 1 (very easy) to 5 (very difficult). Quantitative data are presented as mean and SD or median and interquartile range (IQR). In addition, participants were asked which method they would prefer in a real-life resuscitation.

Apart from those data, sociodemographic data such as sex (female and male), age (in years), level of education (bachelor and master), work experience (in years), and work place (emergency medical service and emergency department) and profession (paramedic and nurse) were documented.

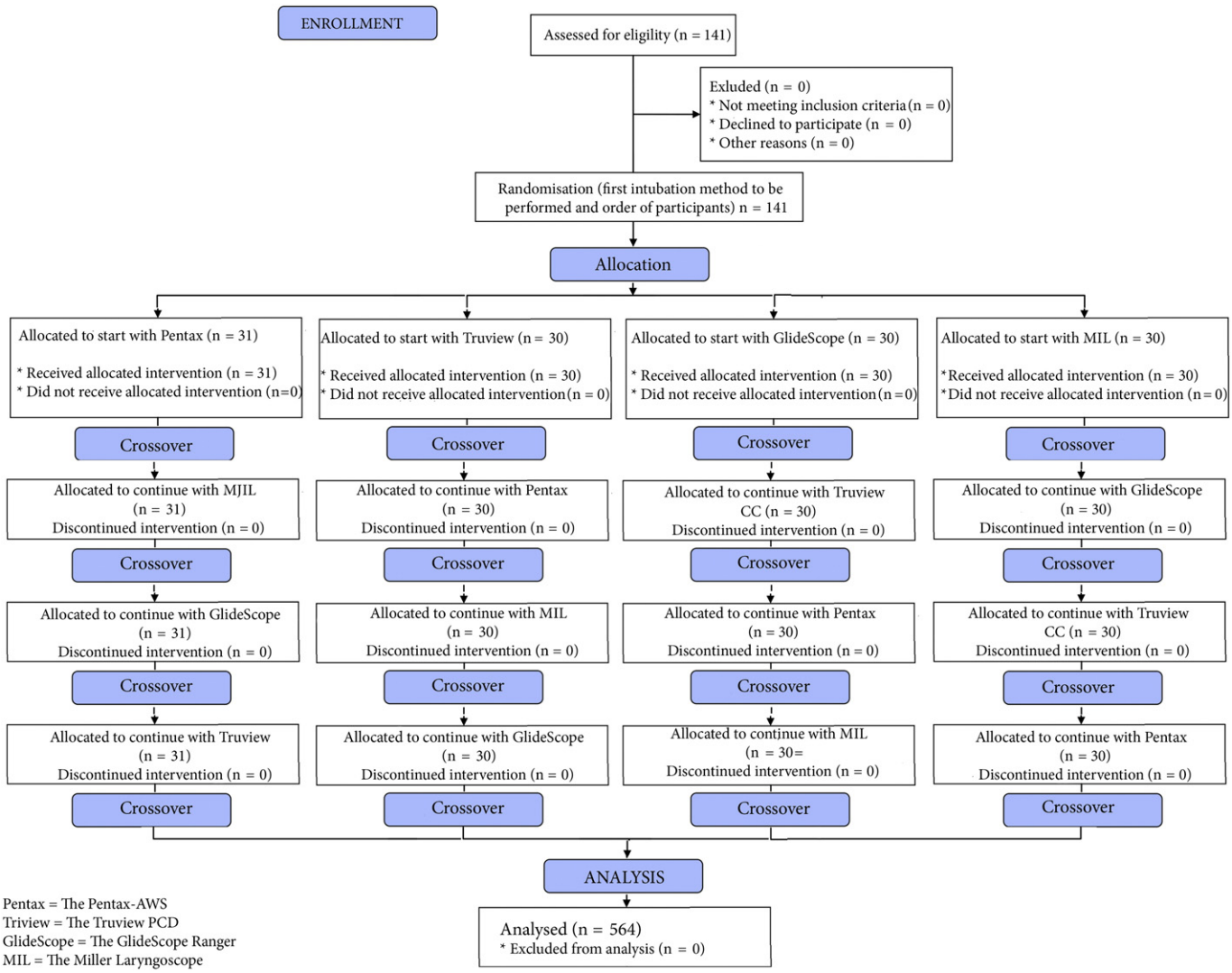

Fig. 1. Randomization flow chart.